

*THE EFFECTS OF DELAYED PHYSICAL PROMPTS
AND REINFORCEMENT ON INFANT
SIGN LANGUAGE ACQUISITION*

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Researchers and clinicians have recommended that sign language be taught to typically developing children during their first 2 years of life; however, existing research does not provide adequate information regarding appropriate methods of sign training. We used delayed physical prompting and reinforcement to teach manual signs to 3 children between the ages of 6 and 13 months. Data were collected on the occurrence of prompted and independent signs as well as crying. Sign training was successful in producing independent signing in all 3 children in under 4 hr of training per child.

DESCRIPTORS: communication training, infants, noncontingent reinforcement, physical prompting, sign language, delay

Recently, researchers and clinicians have begun to recommend that sign language be taught to typically developing infants during their first 2 years of life (Acredolo & Goodwyn, 1996; Garcia, 1999). This recommendation is supported by research suggesting that sign language may be acquired prior to vocal language (Bonvillian, Orlansky, & Novack, 1983; Goodwyn & Acredolo, 1993) and that sign language training may facilitate (and not hinder) the development of vocal language (Goodwyn, Acredolo, & Brown, 2000).

This prior research provides some preliminary support for the use of sign language with infants; however, existing studies provide little information regarding the effectiveness of specific methods of training. In the current study, we evaluated the effects of delayed physical prompting and reinforcement on the independent signing of 3 in-

fants, including 1 child who was just 6 months old at the start of the study.

METHOD

Participants and Setting

Participants were 3 typically developing infants who attended a full-day infant and toddler program. At the start of their participation in the study, Alice and Anna were 13 months old and Lyle was 6 months old. None of the participants communicated consistently through vocal or signed communication. Sessions were constructed to teach children to request items or activities that the infants' parents or teachers identified as preferred. Alice and Anna were taught to request an assortment of toys (e.g., baby dolls, musical toys), and Lyle was taught to request a bite of baby food. Lyle's sessions were conducted during his regularly scheduled mealtime, and the classroom menu determined the foods (e.g., baby cereal, pureed fruit) presented in the session. Experimental sessions were conducted in a small therapy room equipped with a one-way observation window. Sessions were 5 min in length and were conducted one to three times per day, 5 days per week. Sessions were scheduled so

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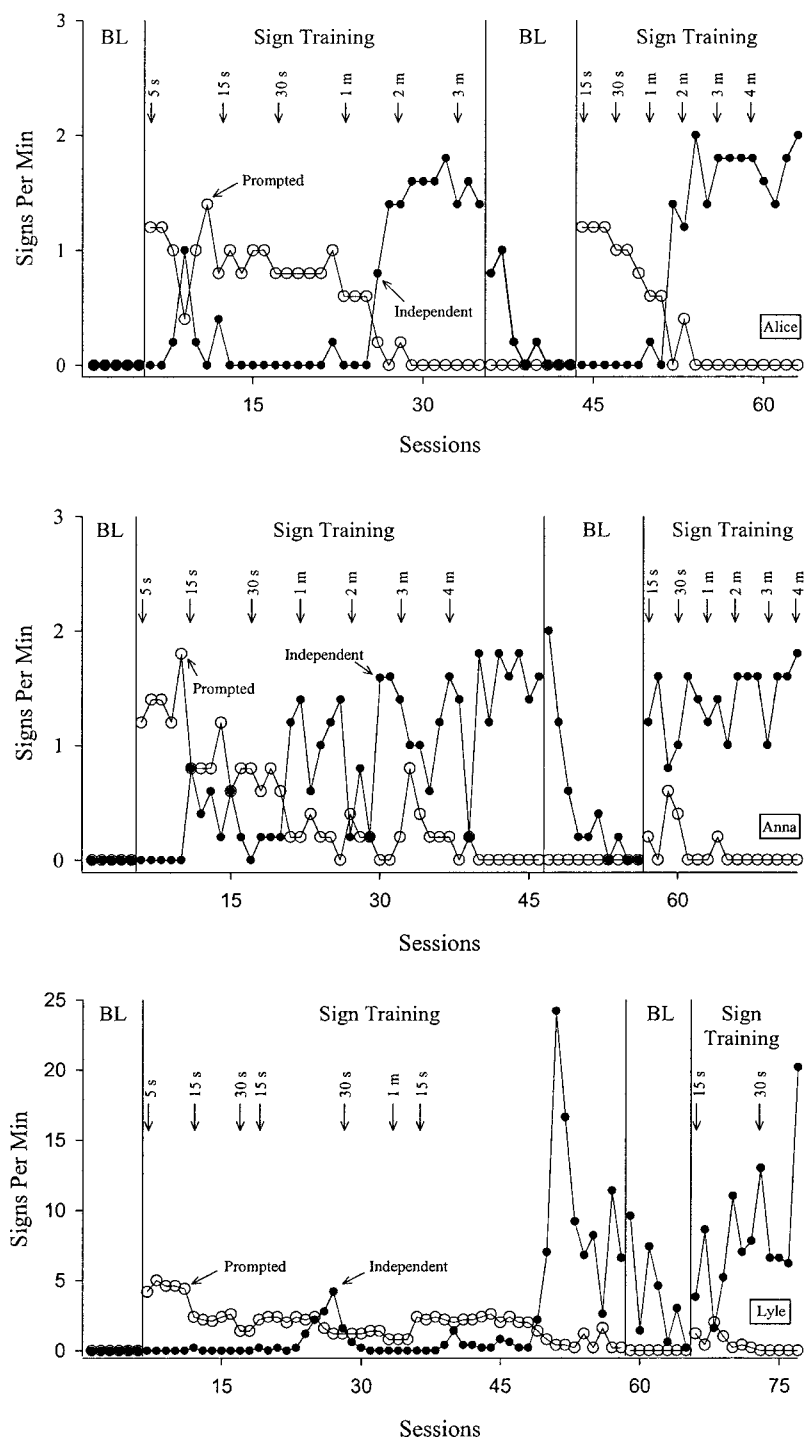


Figure 1. Alice's (top panel), Anna's (middle panel), and Lyle's (bottom panel) prompted and independent signs per minute, during baseline and sign training.

that they did not interfere with children's daily routines (e.g., napping, diapering).

Response Measurement and Interobserver Agreement

For all participants, observers recorded the frequency of independent and prompted signs. The target sign for Alice and Anna was the American sign language (ASL) sign for "please." An independent sign was defined as the palm of one hand touching the chest while moving back and forth. The target sign for Lyle was the ASL sign for "more." An independent sign was recorded if Lyle moved both hands toward his midline and touched them together. For all participants, a prompted sign was recorded if the target sign occurred with any physical assistance from the experimenter.

Interobserver agreement was assessed by having a second observer simultaneously but independently record data during a minimum of 33.3% of sessions for each participant (range, 33.3% to 40.3%). Agreement percentages were calculated by partitioning the session into 10-s intervals and comparing observers' records on an interval-by-interval basis. The smaller number of responses in each interval was divided by the larger number; these fractions were then averaged across intervals and multiplied by 100% to obtain a percentage agreement score. Mean agreement across participants was 93.8% (range, 92.5% to 95.6%) for independent signing and 96.5% (range, 94.5% to 98.3%) for prompted signing.

Procedure

Initial baseline. During baseline sessions, the reinforcer (toys or food) was presented according to a time-based schedule, independent of the participants' behavior. For Alice and Anna, the experimenter presented the toys every 1 min for 30 s. For Lyle, the experimenter presented one bite of baby food at the beginning of the sessions and 20

s after Lyle swallowed each previous bite of food. Beginning in Session 9, Lyle also received brief attention (e.g., "yummy apple-sauce") each time a bite of food was presented. Schedules of reinforcer delivery were established arbitrarily during the initial baseline phase.

Sign training. When sign training was initiated, participants were physically prompted to perform the target sign after a 5-s delay, and the designated reinforcer was delivered following prompted signs. In addition, if participants performed an approximation to the sign (e.g., if Lyle brought his hands toward his midline but did not touch them together), a physical prompt to perform the sign accurately was provided (e.g., the therapist gently guided his hands together), followed by the presentation of the reinforcer. If independent signing occurred at any time during the session, the reinforcer was presented immediately. The subsequent prompt was delivered 5 s after reinforcer removal (Alice and Anna) or consumption (Lyle). The delay to the physical prompt was gradually increased from 5 s to 4 min, or until high levels of independent signing were maintained. Procedural modifications to Lyle's sign training are described below.

Reversal to baseline. Procedures were similar to the previous baseline phase, except that the schedule of reinforcer delivery was based on the mean interresponse time (IRT) from the last five sessions of the sign training condition. Alice received toys 9 s after their removal, and Anna received toys 7 s after removal. Lyle received a bite of food 8 s after consuming each previous bite.

Experimental Design

The effects of sign training were evaluated by comparing data from baseline and sign training conditions in a reversal design.

RESULTS AND DISCUSSION

Alice did not sign during the initial baseline phase (Figure 1, top). During sign train-

ing, a large increase in independent signing was observed at the 1-min delay to the physical prompt, and high levels of signing were maintained with no prompts at the 3-min delay. Independent signing decreased rapidly during the return to baseline. Sign training was then reinitiated at the 15-s delay to physical prompt. Again, Alice's independent signing increased dramatically at the 1-min delay and was maintained at high levels, without prompts, at the 3- and 4-min delays.

Anna did not sign during the initial baseline phase (Figure 1, middle). Sign training was associated with a gradual increase in independent signing and a decrease in prompted signing as the delay to the physical prompt was increased. High and stable levels of independent signing were achieved, with no prompts, at the 4-min delay. A rapid decrease in independent signing was observed during the return to baseline. Anna immediately displayed high levels of independent signing when sign training was reinitiated at the 15-s delay to the physical prompt, and high levels of signing were maintained in the absence of prompts.

Lyle did not sign during the initial baseline (Figure 1, bottom). Sign training was then initiated at the 5-s delay to the physical prompt. The 30-s delay to the physical prompt was associated with an increase in crying; therefore, the 15-s delay was reinitiated (Session 19). The 15-s delay to the physical prompt remained in effect for an additional nine sessions, when an increase in independent signing occurred. After three sessions with high rates of independent signing, the delay to the physical prompt was increased to 30 s and then to 1 min to further promote independence; however, this modification resulted in a decrease in independent signing. Therefore, the 15-s delay to the physical prompt was implemented (Session 36) until high rates of independent signing were regained. High levels of signing

were achieved after 14 sessions at the 15-s delay. The return to baseline resulted in a gradual decrease in independent signing, and independent signing gradually recovered when sign training was reinitiated at the 15-s delay. During the last five sessions, Lyle's signing was maintained with no prompts.

We found that delayed physical prompting and reinforcement were effective in producing independent signing by 3 infants. Independent signing was produced after less than 4 hr of training with Lyle and approximately 2 hr of training with Alice and Anna. This amount of time may be considered relatively small when one considers the time-consuming nature of most infant routines (e.g., feeding, diapering). In fact, the training was accomplished within activities (mealtime, play) that occur several times each day for all children. Thus, sign training conducted in this fashion can be accomplished with minimal additional effort on the part of caregivers.

There are several important questions that should be addressed in future research. First, a component analysis of the sign training procedures is necessary to identify the functional features of this intervention. Second, additional studies should evaluate the effects of alternative training procedures (e.g., modeling) and compare strategies to identify the procedures that produce the most rapid acquisition of sign language. Third, additional research is needed to determine the extent to which the effects of sign training generalize to nontraining conditions and to evaluate the effects of infant sign training on undesirable behavior such as crying, tantrums, or aggression.

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